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RAINFALL AT MUSCATINE, IOWA[1]

By Wm. P. Molis[2]

This paper gives data of the rainfall in eastern Iowa covering a long period of years. The value of such data in determining the relation of precipitation to the floods in rivers and stream and the stored water in lakes is well known. The rainfall is the source of the water supplies of our communities, and long-time records of it are invaluable in estimating the quantity of water obtainable from a surface supply and in investigations of the quantity which exists as ground water. Such data are also valuable in studies of the relation between rainfall and floods. Few who have not experienced flood difficulties realize the danger which may arise if their pumping stations and machinery are situated on low lands exposed to overflow. A rain of one week or a cloudburst will suddenly swell the streams to such a height as to make quick work by the water department necessary in order to save the plant from being put out of commission.

In view of the special importance of rainfall records to water works this paper calls attention to the data which have been collected at Muscatine, as showing what can be obtained in other cities, to a greater or less degree, if the superintendent will make a point of searching for information about old records, which have been kept in a more or less complete form by residents of most cities. Such data should be compiled by the water department of each city as a sort of inventory of its stock that can be made more or less available for the consumers when fully developed.

The author has kept rainfall records personally for the last forty years and has collected such data from others in the city for previous years as far back as 1846. He thus has a rainfall record for the last seventy-three years which is very complete. Table 1 and figure 1 give the annual precipitation, including snow, for this entire period.

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[1] Read before the annual meeting of the Iowa Section on April 16, 1919. Discussion of this paper is requested and should be sent to the Editor.

[2] Superintendent, Muscatine City Water Works, Muscatine, Iowa.

TABLE 1

Annual rainfall, including melted snow, at Muscatine, Iowa during seventy-three years; in inches

FIRST YEAR IN DECADE	YEAR IN DECADE									
	0	1	2	3	4	5	6	7	8	9
1840	—	—	—	—	—	—	34.55	28.50	39.62	59.16
1850	49.08	74.50	59.39	44.92	23.66	31.13	41.94	34.85	58.45	35.96
1860	25.10	44.23	53.16	28.83	32.77	34.21	32.86	34.24	40.91	43.36
1870	24.61	36.11	35.41	28.43	34.78	37.59	53.57	44.78	39.30	33.83
1880	36.78	45.66	46.67	41.12	45.49	39.34	34.22	28.30	38.89	33.49
1890	30.30	34.90	49.71	30.68	27.82	28.09	34.49	49.71	34.08	27.26
1900	32.30	24.50	47.57	33.68	28.22	32.59	29.51	34.26	38.91	37.62
1910	23.04	39.50	26.50	30.94	23.67	35.70	33.29	26.07	37.44	

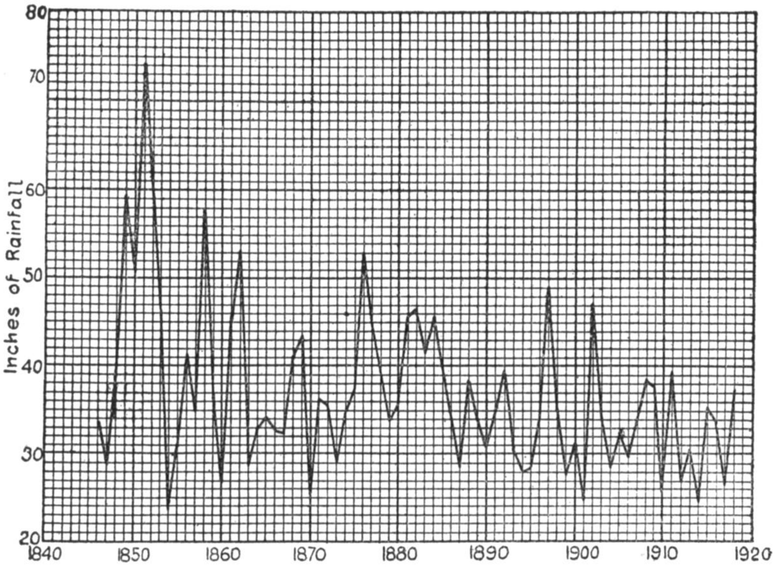

FIG. 1. ANNUAL RAINFALL, INCLUDING SNOW, AT MUSCATINE, IOWA

The total rainfall during all these years was 2,720.40 inches or 225.20 feet. The average was about 37 inches. The minimum for the whole period was 23.04 inches, in 1910, and the maximum was 74.50 inches, in 1851. This is a range of 51.06 inches or 2¼ times the minimum. Or the average, expressing the relation in another way, is about 14 inches above the minimum and 37½ inches below the

TABLE 2

Total and average annual rainfall, including melted snow, by periods of ten years, at Muscatine, Iowa; in inches

PERIOD	TOTAL	ANNUAL AVERAGE	PERIOD	TOTAL	ANNUAL AVERAGE
1846–1855	444.51	44.45	1886–1895	336.40	33.64
1856–1865	389.50	38.95	1896–1905	344.40	34.44
1866–1875	346.30	34.63	1906–1915	318.95	31.89
1876–1885	425.54	42.55	*1916–1918	*96.30	32.10

* Three years only.

TABLE 3

Monthly rainfall, including snow, at Muscatine, Iowa, in 1905–1918 inclusive; in inches

	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918
January	0.93	2.35	3.77	1.11	2.19	1.73	1.38	0.27	0.58	1.20	2.11	5.29	0.99	1.16
February	1.37	2.78	0.26	2.07	2.30	0.74	3.88	1.89	1.86	0.89	2.51	0.63	0.17	1.57
March	2.20	2.72	1.65	2.77	1.58	0.36	0.95	1.90	1.97	1.92	0.76	2.67	0.89	0.25
April	3.41	1.75	2.21	2.35	5.46	2.40	3.45	2.49	2.30	1.81	0.83	1.25	3.21	3.41
May	3.20	3.49	4.04	5.97	3.35	4.24	2.65	2.64	6.43	1.43	5.95	4.27	4.30	8.10
June	4.36	3.56	4.21	4.05	4.43	2.62	2.33	1.41	7.31	5.30	4.27	4.16	4.83	4.63
July	4.59	1.86	7.97	4.25	3.63	2.94	4.33	4.80	0.29	0.95	5.00	1.43	2.82	4.22
August	3.36	2.32	5.16	8.35	2.61	3.17	3.11	2.49	3.07	1.72	2.05	2.83	1.81	5.91
September	1.43	2.67	2.37	2.73	1.96	2.80	8.58	1.58	2.63	4.68	7.60	4.35	4.16	2.03
October	4.49	1.75	1.09	1.98	1.68	0.66	2.48	4.74	3.20	1.80	0.68	2.91	2.02	2.75
November	2.28	2.34	0.89	2.78	5.53	0.42	4.32	1.32	0.24	0.12	3.08	1.36	0.18	1.88
December	0.97	1.74	0.64	0.50	2.90	0.96	2.02	1.00	0.97	1.85	0.86	1.69	0.69	1.53
Total	32.59	29.51	34.26	38.91	37.62	23.04	39.50	26.50	30.94	23.67	35.70	33.29	26.07	37.44

maximum. This shows the relatively small influence on the long-time averages of rainfalls above about 40 inches annually, a fact that is also indicated in figure 1.

In studies of rainfall it is sometimes desirable to smooth out the effect of exceptional years by using the averages of ten-year periods instead of the annual records. These ten-year averages are given for the entire period of seventy-three years in table 2, which discloses the interesting fact that three of these ten-year averages exceeded the annual average of seventy-three years and four of these averages were below it.

It is becoming more common in certain investigations of rainfall to employ monthly averages, since these show the distribution of the precipitation during the year. The records of this kind at Muscatine during the period 1905 to 1918 inclusive are given in table 3, which shows extraordinary ranges in some of the months. The maximum for any one month was 8.58 inches, in September, 1911, and the minimum was 0.12 inch, in November, 1914. The difference is 8.46 inches, or 70½ times the minimum.

TABLE 4

Rainfalls, including snows, at Muscatine, Iowa, since 1903, amounting to or exceeding 1.50 inches in twenty-four hours

YEAR	DATE	INCHES	YEAR	DATE	INCHES	YEAR	DATE	INCHES	YEAR	DATE	INCHES
1904	Dec. 12	2.00	1907	July 10	2.10	1911	July 28	1.55	1916	Jan. 26	1.75
	Dec. 27	1.56		Aug. 15	1.85		Sept. 11	2.00		Mar. 26	1.95
1905	Jan. 6	1.50	1908	Aug. 11	3.15	1912	July 20	1.77		May 14	2.02
	June 9	2.57		Aug. 15	1.65	1913	May 1	1.94	1917	Sept. 7	1.50
	July 1	1.78		Aug. 28	2.47	1914	June 22	1.54	1918	May 23	2.00
	Oct. 16	2.77	1909	June 10	1.70		Sept. 5	2.20		July 6	2.35
1907	May 23	1.45		Aug. 27	1.90	1915	May 26	2.05		Aug. 17	1.80
	July 8	1.86		Nov. 7	1.54		Sept. 10	2.80	1919	Mar. 16	3.50

If the records are separated into two thirty-year periods, 1846 to 1875 inclusive and 1876 to 1915 inclusive, it will be found that the annual average for the first period was 39.34 inches and for the second 36.88 inches, or 2.46 inches less. These figures are interesting as showing by comparison with those previously stated how the effect of time is to smooth out the great differences in the averages of short periods.

In studies of the effect of rainfall on the stages of rivers and lakes it is necessary to have a knowledge of storms of unusual severity. The severity of a storm is an essentially local matter in every way, for an exceptional downpour at Muscatine would be regarded as nothing but a brisk shower on the Canal Zone. For Muscatine purposes, it has been assumed that a rainfall or snowfall of 1.50 inches in twenty-four hours was sufficiently exceptional to deserve special record. Accordingly table 4 has been prepared, giving a record of all such precipitations in the last fifteen years. From this table the curve given in figure 2 has been plotted, from which it is possible to estimate the probability of a rainfall of any intensity occurring at any time. For instance, a 2-inch fall occurs about once a year, and if none occurs during the first six months of a year a study of table 4 and figure 2 will show that it is prudent to expect a precipitation of 2 inches or more in twenty-four hours during the last half of the year, probably in July, August or September.

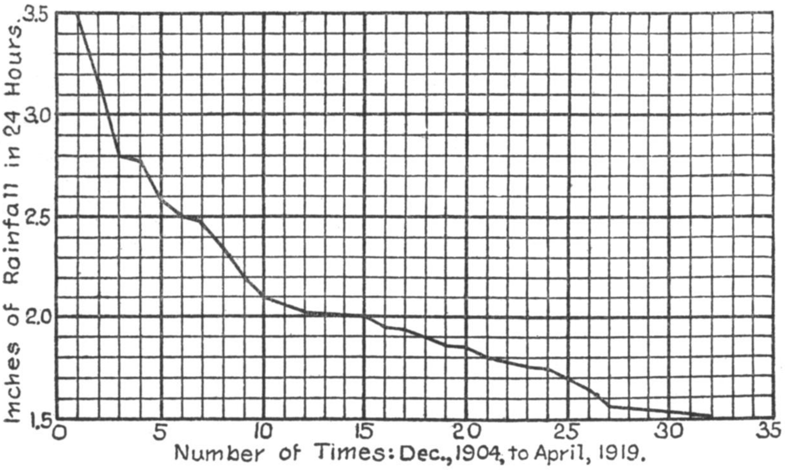

FIG. 2. FREQUENCY OF RAINFALLS OF 1.5 INCHES OR MORE IN 24 HOURS AT MUSCATINE, IOWA